



## **KPIs for measuring the sustainability performance of ecodesign implementation into product development and related processes: a systematic literature review**

**Rodrigues, Vinicius Picanco; Pigosso, Daniela Cristina Antelmi; McAloone, Tim C.**

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#### **Title:**

**KPIs for measuring the sustainability performance of ecodesign implementation into product development and related processes: a systematic literature review**

#### **Authors & affiliations:**

*Vinicius P. Rodrigues, Daniela C. A. Pigosso, Tim C. McAloone*  
*Section of Engineering Design and Product Development, Department of Mechanical Engineering,*  
*Technical University of Denmark*  
*vipiro@dtu.dk*

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The development of products with improved environmental performance is increasingly part of companies' engagement towards sustainable development. Ecodesign is an approach for integrating environmental aspects into the product development and related processes (PDRP), such as manufacturing, marketing, procurement etc. in order to develop products with increased environmental performance.

The application of ecodesign potentially presents a set of sustainability benefits, such as innovation potential, development of new products and business models, the ability to meet or exceed customer expectation regarding the product/service, reduction in environmental liability and improvement of organizational brand, promotion of health and safety aspects along the life cycle, among others.

However, despite the potential benefits and the existence of systematized frameworks for ecodesign implementation, many difficulties still surround the implementation and management of ecodesign. The main challenges in embedding ecodesign into PDRP are: (i) the lack of support to select key performance indicators (KPI) to measure how well a company is being successful in ecodesign integration from a product development process perspective; and (ii) to quantify the sustainability benefits of ecodesign implementation.

Various frameworks for performance measurement systems (PMS) have been proposed, such as the Balanced Scorecard (BSC) and Neely's "Performance Prism". The PMS bundles the set of individual indicators with the company's internal and external environment. However, these framework-based approaches do not incorporate the sustainability dimensions. Furthermore, their use in product development activities have been criticised in the literature due to the fact that the traditional accounting measure are not suitable for strategic-level decision. Besides, the traditional metrics are also pointed out to be historical and hard to correlate, providing little information on the root cause of problems. The literature also highlight the fact that research and development performance is not focused on the performance result's impact on the overall corporate behaviour.

This research aims at presenting a comprehensive set of sustainability KPI to measure the ecodesign implementation into the PDRP by systematically reviewing the relevant literature regarding sustainability KPIs (social, economic and environmental dimensions). The underlying research question is "which are the KPIs for measuring sustainability of ecodesign integration into the product development and related processes?" This research excludes the indicators dealing directly and exclusively with product's attributes and properties, such as energy and material consumption, once the main focus is positioned at the development process itself.

The main results of this research include: **(i)** a comprehensive database of sustainability KPIs for PDRP; and **(ii)** a common ground for communicating and reporting improvements in ecodesign implementations. These results are expected to lead the pathway for building a sustainability-focused performance measurement system and ground an accurate assessment of sustainability integration into the PDRP.

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Furthermore, with a more appropriate sustainability-based performance measurement system in place, companies will be able to perform benchmarking, including intra-sector and cross-sector settings. Initial discussions on how to incorporate these KPI in an effective decision-making approach for implementing ecodesign into manufacturing companies is carried out in this paper. These perspectives lead to some suggestions of future work, which are based on deriving relationships between PDRP sustainability indicators and ecodesign management practices as a stepping-stone for building relevant assessment tools in the field of sustainability performance of ecodesign implementation.